APPLE SYRUP—A PROMISING NEW OUTLET FOR CULL APPLES

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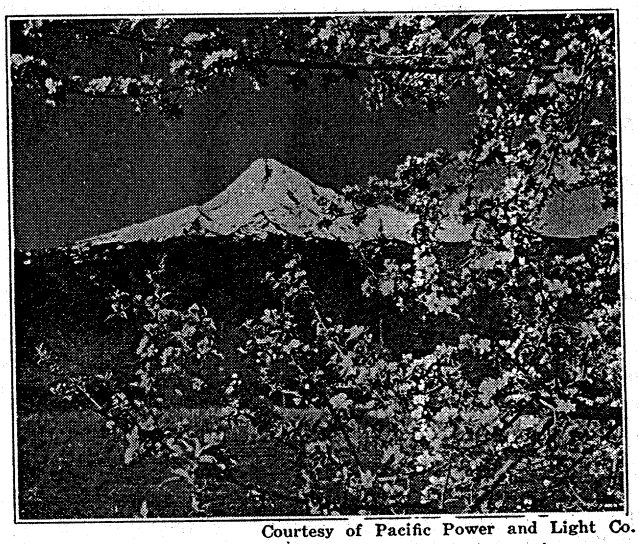

Courtesy of Pacific Power and Light Co.
Apple Blossoms, Mt. Hood in the background.

Courtesy of Pacific Power and Light Co.
Harvesting apples.

Apple sirup, a new product developed by the Eastern Regional Research Laboratory, has created widespread interest as a promising outlet for substantial quantities of cull apples. It is also an outlet for peelings, and cores, which hitherto have been either wasted or only partly utilized for making cider and vinegar. There are annually available as raw material approximately 25,000,000 bushels of cull apples and 30 percent waste from processed apples in the form of peelings and cores.

The process for making apple sirup[2] consists essentially in liming the apple juice (prepared in the usual way) to a pH of 8.0 to 8.5, heating to 175° F. to precipitate the pectin, filtering, acidifying with dilute sulfuric acid to a pH of 5.0 to 5.5, and concentrating under vacuum to 75° Brix. Diatomaceous earth filter aid is sometimes used to facilitate pressing. The main items of equipment required for processing are:

Juice-storage tanks
Liming tank, with agitator and heating coil
Acidifying tank, with agitator
Filter press. The plate-and-frame type is satisfactory
Vacuum evaporator, condenser, and accessories
Pumps for juice, sirup, water, and filter.

The tanks and filter press may be made of wood; the vacuum evaporator may be copper, stainless steel, or glass lined. If made of copper, the evaporator should be thoroughly cleaned before use. Iron is not satisfactory, owing primarily to its reaction with the tannic acid of the juice.

Assuming a yield of 160 gallons of juice of 12.5° Brix from a ton of apples and a 10-percent loss of juice in the process, a ton of apples yields 211 pounds of sirup. On this basis, a bushel of apples yields 5 pounds of sirup, and a gallon of juice yields 1.32 pounds.

To justify the establishment of a plant for commercial production, there should be available a supply of approximately 5,000 gallons of juice daily for a 100-day period. It is possible to extend the production season by the addition of preservatives, such as sulfur dioxide or benzoate of soda, to the juice. If the former is used, it must be removed by heat or agitation before the juice is limed. If the apple sirup is to be added to smoking tobacco to keep it moist, the benzoate of soda may be used, but in foods this preservative may be objectionable.

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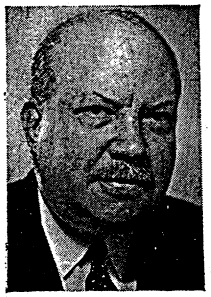

Charles A. Myers

Charles A. Myers, vice president and general manager of Dodge and Olcott, is a working chemurgist. As a producer of aromatics and essential oils, his daily activities are devoted to many chemurgic products.

Mr. Myers was born in New York City. His ancestors came to this country and settled in that part of New York City now known as Harlem, in 1661. His interest in perfumes, extracts, and allied products resulted in specialized study at Columbia University College of Pharmacy during 1926 and 1927.

From 1917 until 1919, Mr. Myers served in the U.S.N.R.F. and as chief petty officer in the chemical service from 1919 to 1921. He has contributed a number of new devices to the science of fuel analysis and has been awarded the Victory Medal by the United States and by New York State.

He joined the staff of Dodge and Olcott Company of Bayonne, N. J. in 1907, serving in various capacities until 1938 when he became first vice-president and general manager in addition to a member of the board of directors.

As evidenced by the fact that he holds a navigator's license for vessels up to 15 gross tons, Mr. Myers is deeply interested in the sea and its lore. For the last quarter century or so he has been engaged in building a series of models showing the development of naval architecture since the dawn of civilization. This series of models is the only set of its kind, representing years of study and travel to accumulate the necessary data for accurate construction. The complete set will consist of 20 or 21 pieces showing the development of the capital ship since the days of the Egyptians.

ILLINOIS ACTIVITIES

The annual banquet of the Illinois Crop Improvement Association was held at Urbana, Illinois, on February 9th and created considerable interest throughout the Midwest. The dinner menu contained several items from soybeans which enhanced the pleasures of the table and caused considerable comment.

Dr. W. L. Burlison, head of the department of agronomy of the University of Illinois, was toastmaster and during the evening session awards were made for the 10-acre corn growing contest and the 10-acre soybean contest.

AGRICULTURE AND SCIENCE IN CANADA

In the relationship between the Canadian farmer and the Canadian scientist, there has been a remarkable change since the beginning of the twentieth century. The scientist has taken his methods to the fields; the farmer has brought his problems to the laboratory. To apply the laws of science to the everyday practices of agriculture is one of the functions of the research workers of the Dominion Department of Agriculture, mainly through its Science Service, and the Experimental Farms, in addition to the agricultural scientists at the several universities and agricultural colleges and, to some extent, by industry.

In the field of agricultural research, Canada is second to none in the fine work done by her trained specialists. In agriculture, particularly with reference to the all-important production of food, research work, as pointed out by Dr. E. S. Archibald, may be conveniently divided into three groups: (1), research in production; (2), research in marketing, and (3), research in absorbing special crops, surpluses and wastes.

Canada's plant breeders have opened up many millions of acres through the development of earlier maturing and more suitable types of crops in cereals, forages, and horticulture, and to these accomplishments have been added the protection of these acres through the creation of disease and insect resisting varieties and types of crops. Because of the development of new types and varieties of tobacco and cultural methods adaptable to Canadian conditions, large new areas have been opened up, and other crops, such as fiber flax, have been introduced, improved, and adapted to various parts of Canada. One of the most recent accomplishments, and one probably of the greatest value in wartime, is the study of Vitamin B_1 values of wheats. —*Canadian Pacific Railway.*

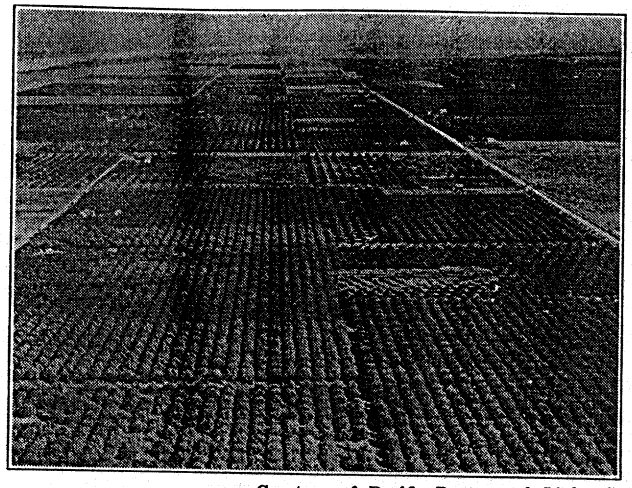
NEW DRUG "MOST WIDELY USED"

A thumbnail version of the story of phenothiazine forms a paragraph in a recent address by A. O. Foster, parasitologist of the United States Department of Agriculture.

"Phenothiazine," says Dr. Foster, "is a synthetic coal-tar derivative—an organic chemical compound—that has become, in less than 5 years since the discovery of its anthelmintic action, the most widely used of all drugs for the removal of internal parasites but it is effective against most of the economically important stomach and intestinal roundworms. It is used in more kinds of livestock and possesses effective action against a wider range of parasites than any other drug of its class. Currently it is being used in this country at the rate of about 3 millions pounds annually; it is also being used in many other countries, especially the British Empire and its dominions. The supply appears to be ample, but the chemical from which phenothiazine is made, diphenylamine, is employed in the manufacture of nearly all explosives, war gases, and rubber. Therefore, phenothiazine is ammunition, and, like ammunition, it should be used not too sparingly, but wisely and effectively."

* * *

From the combined thoughts of many individuals will come inventions, new processes, new applications and new methods of attack of old problems.—Dr. H. K. Benson, University of Washington.



Courtesy of Pacific Power and Light Co.
Apple orchards in the Pacific Northwest.

Plants already established in apple-growing areas for evaporating products such as maple sirup and milk, which have their peak season in the spring, are in a particularly favorable position for producing apple sirup, owing to the lower capital overhead chargeable to apple-sirup production.

Apple sirup is a clear, amber-color liquid with a viscosity of about 1,000 centipoises, corresponding to that of sucrose or invert sugar of about the same solids content. It contains approximately 37 percent levulose, 14 percent dextrose, 14 percent sucrose, and 10 percent non-sugar solids. This combination of sugars has the distinct advantage that no one sugar will separate on drying; hence it not only acts as an efficient hygroscopic and sweetening agent but has a plasticizing action even at a low humidity. Because of the high levulose content, it is approximately 20 to 30 percent sweeter than a cane sugar sirup of equal solids content.

Apple sirup is used in the cigaret industry, as a humectant, for which purpose 35,000,000 pounds of glycerin are normally consumed each year. It is now being widely tested for use in other products for which its hygroscopic and sweetening characteristics or its plasticizing properties are desirable, such as pharmaceuticals, bakery products, milk modifier, spray-dried milk, confectionery, table and fountain sirups, coated paper, ground-cork sheeting, leather, and cosmetics.

Modifications of the process are being developed in order to prepare products with the specific characteristics required by special markets. For example, as the lime normally present in apple sirup is not compatible with the oils and soaps used in cosmetics, dentifrices, and textile finishes, the sirup can be treated with ion exchange resins to reduce the lime to a minimum. Tests are also being conducted to develop a product with a strong characteristic apple flavor. Sirup with higher viscosity can be produced by retaining the natural pectin.

The pomace, the residue after the juice has been extracted from the apples, can be dried for subsequent sale to pectin manufacturers. At present, the ceiling price on dried apple pomace is 4 cents a pound ($80 a ton). Last season, the price ranged from $45 to $90 a ton according to the quality. When the price and quantity available do not justify drying the pomace may be applied to the land, and if diatomaceous earth has not been added it may also be fed to cattle.

During the 1942-43 apple season, approximately 3,000,000 pounds of apple sirup was produced by five companies in the United States and Canada. The selling price ranged from 13 to 22 cents per pound. Since then, the capacity for apple-sirup production has been greatly extended. A ceiling price of 17 cents per pound has now been established.

1 This is one of four Regional Research Laboratories operated by the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, United States Department of Agriculture.
2 Bradshaw, M. A., and Mottern, H. H. Production of a Bland Sirup from Apples. ACE-180, 7 pp., 1942, (Mimeographed).

WAXES

9. Spermaceti

Spermaceti or Cetin is an animal wax obtained from the head cavities and the blubber of the sperm whale, Physeter Macrocephalus. Crude sperm oil contains about 11% of Spermaceti. Refined Spermaceti forms lustrous white, translucent masses which are so brittle that they can be readily powdered. The material shows a broad leafy crystalline structure, and is almost without taste and odor. In the melted state it leaves a grease spot on paper. It is easily soluble in boiling alcohol, but only sparingly soluble in cold 95% alcohol.

Spermaceti consists chiefly of cetin, which is cetyl palmitate, the ester of cetyl alcohol and palmitic acid. It is related, therefore, more directly to the fats than to the waxes. Cetyl alcohol is produced when the esters in spermaceti are saponified by alkalies.

The material finds application in candles, soaps, confectionery, cosmetics and in pharmacy, and to some extent as a sizing material. It does not compete in application with Beeswax, Carnauba, or the mineral waxes in polishing and related products. It appears on the market in the grades of blocks and cakes in cases of 50 to 60 pounds, and conforms to the specifications of the United States Pharmacopaea.

KING COTTON IS ALLY OF MARS

Looking forward to changes in store for King Cotton when he is no longer a partner of Mars, War Food Administrator Marvin Jones comments on features of the current association:

"For every 5,000-pound bale of cotton lint there is 900 pounds of cottonseed, with not a pound wasted, not even the hulls. This yields 140 pounds of vegetable oil for food; 400 pounds of meal and cake for livestock feed; about 240 pounds of hull for feed and chemicals; and, finally, 89 pounds of linters for smokeless powder, plastics, and other things. Linters—fuzz on the seed—are the best natural form of alpha-cellulose for making smokeless powder. From hulls come transparent nose sections of bombing planes and the finest synthetic yarns and fabrics. About two-thirds of the billions of yards of cotton cloth go to war. They use cotton in self-sealing gasoline tanks for airplanes; for electrically heated flying suits; for parachute cords and harness; for jungle hammocks, canteen covers, and rot proof shoes for jungle wear; for tarpaulins, camouflage netting, surgical supplies. The list is almost endless. Every soldier requires 250 pounds of cotton or 10 times what the average civilian wears."

WATTLE BARK

By F. J. HERMANN, *Associate Botanist,*
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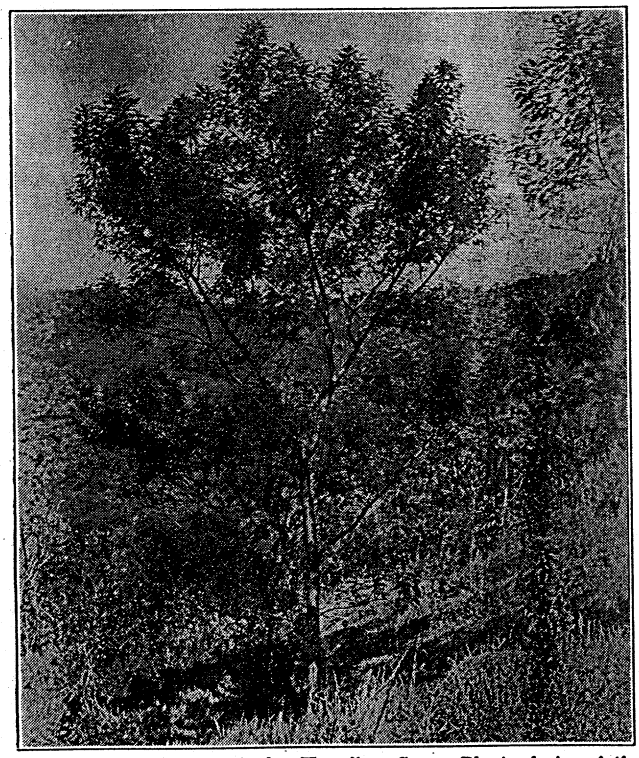
United States Department of Agriculture

Wattle bark is one of the most valuable and most extensively used tanning materials. Obtained from three different species of *Acacia,* which are native to Australia, its popularity among tanners has spread from continental Europe to Great Britain and the United States and is steadily increasing.

Use and Importance

The bark of three Australian acacias is used commercially under the name of wattle bark. Wattle, like quebracho, is an astringent catechol tannin. It is particularly well adapted to sole-leather manufacture but can also be used successfully for light leather. Although wattle bark is classed as a rapid tanning material, the tannin therefrom does not penetrate quite so rapidly as quebracho. The color of the leather, however, is much less red than that obtained from any other catechol tans. The Tanners' Council of America reports that the chief value of wattle tannin lies in its quick penetration, good color, capacity to blend with other tannins, and tendency to dissolve insoluble tans. The tanning solutions produce little acid on fermentation and consequently do not plump well. Wattle therefore makes a good blend with acid-producing tannins such as myrobalans. Wattle leather is firm and durable.

Imports of the bark and extract of wattle into the United States give little indication of the potential importance of wattle tannin, considered either alone or in relation to other extensively employed tannins heretofore obtained from foreign sources. The increasing recognition of the value of wattle bark by the tanning industry is indicated by actual figures which bring out an almost phenomenal growth in the world market for both wattle bark and extract. In 1923 the Hide and Leather Division of the United States Department of Commerce, after an extensive study of the properties and sources of tanning materials, concluded that black wattle would meet the requirements of American tanners more fully than any other foreign vegetable tannin that can be produced in the United States.



Courtesy of the Hawaiian Sugar Planters' Association
Acacia Tree.

This agency emphasized the comparative cheapness of wattle bark and wattle extract in relation to their high tannin content; the early maturity of the bark, combined with the possibility of rotation of crops, insuring a permanent supply of a high-grade and valuable tannin; the constantly growing world market for wattle; and the approaching exhaustion of our domestic supplies. It therefore recommended the establishment of experimental wattle plantations and a thorough investigation of the possibilities of its culture on a commercial basis within the United States and in foreign territory contiguous to the United States, where cheaper labor is available.

Imports of Wattle Bark and Extract Into the United States, by Countries, 1939-40

Item and Country	Quantity 1939	Quantity 1940	Value 1939	Value 1940
	1,000 lbs.	1,000 lbs.	$1,000	$1,000
Wattle Bark:				
British East Africa	8,264	15,067	133	204
Union of South Africa	4,657	1,627	73	24
Total	12,921	16,694	206	228
Wattle extract:				
British East Africa	22	1,232	1	20
Union of South Africa	3,228	1,660	112	56
Total	3,250	2,892	113	76

Value of United States Imports of Specified Tanning, Other Than Wattle Bark and Extracts, in Values, 1939-40

Item	Raw Materials 1939	Raw Materials 1940	Extract 1939	Extract 1940
	$1,000	$1,000	$1,000	$1,000
Myrobalans	268	339	53	21
Quebracho	538	129	5,082	3,932
Valonia	236	129	151	27
Gambier	382	344	—	—
Nutgalls	265	409	—	—
Mangrove	—	168	446	475

Foreign Commerce and Navigation of the United States, 1939-1940.

Plant Source of Product and Botanical Position

The wattle barks of commerce are derived from several species of *Acacia,* a genus of the subfamily Mimosoideae of the Leguminosae. The high tannin content of *Acacia pycnantha* Benth. (golden wattle), *A. decurrens Willd.* (green wattle), *A. decurrens* var. *mollis* Lindl. (*A. mollisima* Willd.) (black wattle), and *A dealbata* Link. (silver wattle) has resulted in their em-

ployment as sources of the commercial bark to the practical exclusion of other species. Of these, the bark of *A. pycnantha* is usually the richest in tannin content, whereas that of *A. dealbata* is the poorest. Both *A. decurrens* and its variety *mollis*, however, possess the advantages of being larger trees, hardier, and of giving on the whole a better yield of bark. Consequently, wherever wattle cultivation has been undertaken on a large scale, *A. decurrens* and *A. decurrens* var. *mollis* have been selected for plantation purposes.

Distribution of the Plants, Wild and Cultivated

The four acacias enumerated are all indigenous to Australia. In 1880, however, wattle culture was introduced into Natal, Union of South Africa, with such unqualified success that the bulk of the wattle bark of commerce has been supplied by that region during the past 30 years. Australia gradually fell behind Natal in wattle production, because exporters relied chiefly on the natural forests of this product, paying little heed to its cultivation. This resulted in Australian tanners being obliged to import wattle bark from Natal in order to meet their requirements, notwithstanding the fact that Australia is the native land of the wattle. The suggestion was made that the cultivation of wattles might be made profitable in Australia, but the Government maintains that the establishment of plantations similar to those of Natal is not practicable in Australia due to the higher cost of labor. Similar considerations would doubtless apply to the United States.

The wattle cultivated in South Africa is *Acacia decurrens* var. *mollis* (black wattle), which was selected after many experiments with the best Australian wattles as being hardier, better suited to the climate, and furnishing on the whole a larger yield of bark than the other species, although the bark contains less tannin than that of the golden wattle (*A. pycnantha*). Black wattle was found to thrive better outside Australia, especially in Natal, than in its native country. The success of the wattle industry in Natal was due to (1) the eminently suitable environment, favoring rapid growth of the tree and enabling the bark to be stripped, if required, within 5 or 6 years from the time of planting; (2) the plentiful supply of cheap labor; and (3) a ready market for the wood for use as pit props and fuel. The erection of a factory for the extraction of tannin at Pietermaritzburg in 1916 resulted in rapid strides in the industry, which soon became one of the greatest importance to South Africa; and it is now considered to be by far the most important of the forest industries of the Union of South Africa and one of the mainstays of that region's progress. In 1921 the acreage devoted to wattle cultivation in South Africa amounted to 312,000 acres, an increase of 56 percent over that of 1913, and it has been expanding continually during the past 20 years.

In 1903 black wattle was introduced into Kenya Colony to provide fuel for the Uganda railway and steamboats, but it did not prove satisfactory for this purpose on account of its rapid-burning properties. The bark was not used in Kenya until 1910; by 1920 the bark was expanding rapidly, and in recent years British East Africa has been competing successfully with Natal as a source of excellent bark. Conditions in Kenya are somewhat more favorable to wattle culture than those in Natal, and the yield per acre is about 6 tons as

Courtesy of the Hawaiian Sugar Planters' Association
Acacia Trees.

compared with 4.5 tons in Natal. The bark produced is of excellent quality, yielding from 35 to 45 percent of tannin. The highlands of Kenya Colony afford a natural home for wattle, and trees planted there are said to mature for stripping 2 years earlier than in Natal.

Several wattles have been acclimatized in different parts of India, and in Ceylon hills *Acacia decurrens* and *A. dealbata* have become plentiful. Black wattle grows luxuriantly in the high ranges and on the Nilgiri Hills of southern India. Investigations as to whether these areas would afford a valuable source of tannin both for local consumption and for export have been markedly successful, analyses of south Indian wattles comparing most favorably with those of other countries.

The cultivation of wattle has also become a promising industry in Madagascar, but the output is not yet extensive. Experimental plantations have been established in Morocco and Java, and wattle cultivation has been suggested for Sicily and the Landes district of France.

Horticultural Technique

Experience has shown that unbroken land gives better germination and growth than cultivated land. Why this should be so is not known. It may be that bacteria required by the black wattle are killed out or that the ground is rendered poor by previous cultivation, but the fact remains that new land broken up especially for the crop is the best and least expensive preparation.

The period of the year in which the work of preparation should be done varies considerably with the locality and the season. In Natal summer plowing is considered best. The plowing should be as thorough as possible. The result of this method shows beneficially throughout the whole rotation of the first crop and again acts advantageously when renewal is in process.

Autumn sowing usually produces the best results, as the seeds germinate but the plants remain small and prostrate during the first winter and are thereby free from effects of frosts. If sown in the spring, the trees are more or less vigorous by the following autumn, when they have attained a height ranging from one to several feet and are then in condition to be more readily affected by frost. The application of a good fertilizer

can be made with profit, but over-manuring must be avoided.

The seeds of black wattle possess such hard shells that artificial treatment is required to hasten germination. This consists in soaking the seed in boiling water (if very old, boiling for a short period is advisable—never for more than one hour, but the exact period in each case must be determined by experiment) and allowing it to remain in the water for about 24 hours after cooling. Owing to the gelatinous condition produced by soaking, the seeds are usually mixed with fine dry sand which dries and separates them. They are sown immediately after soaking on land that has previously been well harrowed down. The depth at which the seeds are sown should not exceed more than a half inch. After germination the plants grow quickly, and when 4 years old they have generally attained a height of 25 to 30 feet. The foliage is luxuriant and affords excellent shade for animals.

As to spacing, it has been found most satisfactory to sow the plants in rows from 9 to 12 feet apart and 6 feet apart in the line. The rotation was formerly from 6 to 7 years, but 7- to 12-year rotations have been found to result in bark twice that obtained in the shorter rotation and in the timber being changed from firewood to useful mining timber. In some circumstances, however, the cutting of the trees at an earlier stage pays; and at times, when there has been a scarcity of bark and consequent high prices, quite young trees 5 to 6 years old, have been stripped.

Felling is usually performed on contract. Where the crop is good and the bark peels easily, 1,000 pounds of the green bark per day is considered reasonable; but during a dry period, when the trees are stripping badly, 500 pounds may prove an excessive task. The bulk of the profit or loss, therefore, lies in economic handling, by felling at the season when the largest return can be had for a day's labor. Moisture has a deleterious effect on stripped bark, so that every precaution should be taken to prevent exposure to moisture. Drying sheds are an absolute necessity if rain occurs when large quantities of bark are being handled. Under no conditions should any portion of the under surface of the bark be exposed to the sun, since such exposure produces discoloration.

Natal wattle bark, in air-dried condition containing usually 10 to 12 percent of moisture, is shipped in bags or bales either as stick bark, chopped bark, compressed bark, or shredded or ground bark. Bales of chopped bark take up a space of 85 cubic feet per ton, compressed bark about 55, and ground bark 50 cubic feet. The percentage of tannin in the bark ranges from 30 to 45 percent, with the average about 33 percent. The solid extract, which contains about twice as much tannin as the bark, occupies space of about 40 cubic feet per ton.

With regard to tannin content of the bark, this varies considerably both between species and within a species. The best commercial *Acacia pycnantha* bark contains an average of about 38 percent tannin. As mentioned previously, however, this species is less adaptable to diverse climatic conditions than are the black and green wattles. *Acacia dealbata* is definitely inferior, containing usually not more than 20 percent. Australian black wattle contains from 31 to 39 percent tannin; samples from plantations in Madras, India, contained 35 to 47 percent, but from Ceylon 27 to 33 percent.

Definite figures on the average returns per acre cannot be given, because climatic conditions, soil, and methods of culture have an enormous effect upon crop production. Generally, however, a 7- to 8-year old crop is regarded as good if about 4 tons of bark and 20 tons of timber per acre are obtained. In many localities crops of half that size have been worked with profit. When longer rotation is adopted, however, with resulting heavier mining props and heavier bark, double the foregoing weights can be obtained after the trees have reached an age of 10 or 12 years, with greater values per ton.

The whole cultural process requires careful watching from time the seed is sown until the crop is harvested, and the volume of the crop will vary with the treatment. If every means by which profit can be procured is taken advantage of, the results will prove much higher than returns from the same ground under negligent treatment.

The wattle industry of Natal has been maintained at considerable expense to the growers, though with large profits. The more progressive farmers are convinced that black wattle of first-class quality will continue to be produced with remuneration to the growers and in such manner that the good years will compensate for the less profitable ones. Judging from average results covering a long period of years, the black-wattle industry may be regarded as a highly lucrative investment.

Byproducts

Although wattle bark has long had an established position among tanning materials, profitable production of the bark so far has depended to a large extent upon the market that could be found for byproducts of the industry, especially for the wood that remains after the bark has been removed from the trunks. Until 20 years ago the timber of black wattle was regarded as being usable only for firewood. Thereafter, the Natal wattles were generally allowed to grow to prop size, rather than to firewood size as formerly, with the result that the industry of supplying mine props to Johannesburg became quite important. Wattle wood weighs about 47 pounds per cubic foot; it is moderately hard and strong, splits easily, and provides useful timber for farm purposes, such as posts, rails, etc.; but it does not last well in the ground even when tarred. There is considerable demand for potato and fruit boxes manufactured from wattle wood. Tests on the uses of the wood as sawn timber in South Africa have given very good results, and no defects due to seasoning processes were noted.

The probabilities are that further outlets for the wood may be found as a paper-making material and as a source of charcoal, acetic acid and its derivatives, methyl alcohol, and tar by destructive distillation. Recent experiments prove that wattle pulp may become an excellent source of valuable vegetable dyes, of which 30 shades ranging from brown to gray have been obtained. A possible further application of the wood is a source of cellulose for the manufacture of artificial silk.

Tests have shown that the spent bark can be utilized in the production of strong wrapping papers and, with bleaching, is suitable for the manufacture of the cheap-

er grades of white and cream paper, such as newsprint.

The promising results obtained with spent wattle bark as a paper-making material suggested experimentation to ascertain whether the wood also could be utilized for a similar purpose, either alone or in conjunction with the bark. The wood alone was found to produce a clean pulp of light-brown color, giving an opaque paper that did not shrink on drying but was lacking in strength because of the shortness of the fibers. But a mixture of 50 percent wattle wood and 50 percent spent bark produced an excellent strawboard, a product in great demand for fruit packing and other purposes both in South Africa and Australia.

To utilize these byproducts profitably the erection of pulp mills near the sources of supply would be necessary to avoid the cost of transporting raw materials.

(Concluded in next issue)

NEW DEVICE AIDS HORMONE GASSING

Increased set of tomatoes and production of seedless fruits now appears to be a practical possibility in greenhouses and may have application in fields and gardens, reports the Agricultural Research Administration, in announcing results of experiments by Harold A. Schomer and Charles Hamner. These scientists of the Bureau of Plant Industry, Soils, and Agricultural Engineering report a new way to treat tomato blossoms with hormones probably much less expensive than any previous hormone treatment. Results are described as remarkable.

Using a modification of the recent aerosol discovery by Lyle D. Goodhue of the Bureau of Entomology and Plant Quarantine, the plant scientists made the hormone applications by releasing a mixture of the hormone and a highly volatile liquid from a strong steel container. The container, as devised earlier by Goodhue, withstands the pressure of the liquid, which is really a liquified gas.

Most important, it is believed, is the insurance of fruit set by the blossoms, but other results with the tomato plants included good growth of the fruit and the production of seedless or practically seedless tomatoes. Tests are now planned to determine the effects of the new treatment on other fruits and vegetables.

Applying naphthoxyacetic acid to tomato plants with the new device, Hamner and Schomer obtained a nearly perfect set of fruit both indoors and out. The fruits, they found, grew faster, developed greater size, ripened sooner, and were nearly or quite seedless.

Applying a hormone to blossoms, it is explained, is not a new means of obtaining a set of fruit. This has been done before by treating individual flowers. The new aerosol application, however, promises a method that is economical on a large scale. It has commonly been difficult to get a good set of tomatoes in the greenhouse, and in hot weather the same difficulty is common in fields or gardens.

In these experiments, 3 grams of the hormone were dissolved in 27 grams of a solvent, cyclohexanone, and this solution put into the cylinder or "bomb" under pressure, with 270 grams of di-methyl ether, which blows off with such force when the valve is opened that the particles of dispersed hormone are so fine as to resemble the finest pollen grains.

The equipment used for making the applications is not available to the public because of war priorities.

TUNG GROWERS MEET WITH THE POST-WAR ECONOMIC DEVELOPMENT COMMITTEE OF LOUISIANA

A meeting of Louisiana tung growers and others interested in the sound development of the domestic tung industry with the Post-War Economic Development Committee of Louisiana, for the purpose of exploring the possibilities for the development of a tung industry in that state during the postwar period, was held under the sponsorship of the United Tung Growers Association at the United States Laboratory for Tung Investigations at Bogalusa on Thursday, January 27th.

The functions of the Committee were explained. Its first function was to interest the various industries in Louisiana to take an inventory of their problems and to stimulate interest by each industry in making plans to solve its own problems.

The tung growers presented a list of proposals on which they desired the backing of the Committee. Included among these were suggestions that the tung be put on the approved list of agricultural crops; that nursery stock of selected trees should be grown and distributed to farmers agreeing to follow the recommended standardized practice; that a standard practice of planting, cultivation and fertilization of trees be recommended and the promotion of planting tung trees as a part of a diversification program in the tung belt. It was also proposed that the Committee have a study made of the use of tung oil. It was further suggested that tests and analyses of tung oil be made. These proposals and others were taken under consideration by the Committee.

OF CHEMURGIC INTEREST

Enough belladonna to supply the institution for more than a year has been harvested recently in the grounds of a large London hospital. The dispensary staff did the necessary work, and little trouble with the cultivation was experienced.

In all the talk about new postwar materials is buried the fact that many of them will result from vastly improved adhesives which bond wood to wood, cloth to wood, metal to metal, wood or plastics. So strong are many of these adhesives, that under stress the material joined gives way before the glue-line does. Du Pont, for example, developed a bonding agent for the cloth-covering over plywood aircraft that, when stripped off forcibly, tears loose the fibers of the wood.

Ten thousand pounds of pyrethrum seed have been obtained from British East Africa for planting in the Americas. Twenty thousand pounds are to go to Russia. The United States is reported as buying the entire Brazilian pyrethrum crop, unofficially estimated at 400 tons of low-grade flowers.

Insecticide shipments overseas are intended to help liberated territories to restore their own food production and thus reduce the burden on United States food supplies, according to an Office of Economic Warfare spokesman.

CHEMURGIC TRADING POST

CTP-32. Supplementing our previous announcement regarding "four feed mills in heart of the soybean growing district," under this same number, we wish to state these plants are soybean crushing mills.

INTRODUCING . . . *More of the Tenth Annual Chemurgic Conference Speakers*

M. F. Taggart,
Director of Research,
O'Brien Varnish Company

Dr. H. T. Herrick,
Director, Northern
Regional Research Laboratory

Dr. Ernest S. Guenther,
Vice President and
Chief Research Chemist,
Fritzsche Brothers, Inc.

CELLOPHANE USED TO PREVENT INFECTION OF BURNS AND WOUNDS

A wrapping of moisture proof cellophane, acting as a barrier against germs which might infect the wound from the outside, is a feature of an improved pressure dressing treatment for burns and other wounds.

The technique, which is employed by Dr. Neal Owens, professor of plastic surgery at Tulane University Medical School, is described in a recent issue of *Surgical Clinics of North America.*

Dr. Owens has been perfecting the pressure method for the past ten years and has used it on several hundred cases. Before adopting the cellophane feature he had noted that even surgical wounds, such as those made during removal of healthy skin for grafting, occasionally became infected through the entire thickness of the dressing. He therefore conducted laboratory experiments which proved that germs could be drawn, by capillary attraction, through as many as 64 thicknesses of gauze. However, when a layer of a special type moistureproof cellophane was interposed the germs could not get through. This led to its adoption.

Pressure dressings for burns have been coming into greater favor during the past year and a half, points out Dr. Owens, who cites the important contributions of Dr. Sumner L. Koch, of Chicago, and others, in this field. The method is supplanting such techniques as tannic acid, which Dr. Owens states has been shown to be destructive of tissue. A burned area which would have healed without grafting is often so damaged by tannic acid, he states, that the skin-forming cells are destroyed and grafting must be resorted to.

After the burned area is gently washed with soap suds and rinsed with saline solution, several layers of gauze are applied and then a thick cushion of sterilized cotton waste is packed around the wound. This is compressed by an outer winding of gauze so that it exerts firm, gentle, well-distributed pressure on the injured surface. The cellophane, first sterilized by steam, is placed over the waste layer. One effect of the pressure, Dr. Owens explains, is to force back into the circulation the fluid part of the blood, which during the patient's shock state following the burn, leaks out into the tissue spades and causes a drop in blood pressure. The dressing is left on for two or three weeks without changing and it not only reduces the chance of infection and minimizes early stages of shock, but relieves pain and shortens the period of hospitalization, Dr. Owens reports.

No medication is used by Dr. Owens in cases not already infected, but in those which are infected and require wet dressings, the cellophane helps retain the moisture in the dressing.

This is one of a number of medical and surgical uses which physicians are finding for cellophane.

RESEARCH IN TEXAS

The board of trustees of Southern Methodist University has authorized the foundation of an institute of technology and plant industry in Dallas, Texas.

The cotton technicians of the National Cotton Council are being transferred to Dallas and will collaborate with the new institute.

The institute will sponsor research which will bring agriculture and industry into closer relationship through the application of science. Dr. C. L. Lundell has been appointed head of this new research institute.

CULTURE STUDIES OF THE DRUG PLANT ATROPA BELLADONNA

By W. R. BREWER and ALEX LAURIE
Ohio Agricultural Experiment Station

A federal cooperative project established in January 1942 by the Ohio Agricultural Experiment Station and the colleges of Pharmacy and Veterinary Medicine of The Ohio State University was continued through 1943 in further search for information needed for the culture of certain medicinal plants, the imports of which have been curtailed by war activities.

The plant, *Atropa belladonna*, a member of the *Solanaceae* family native to central and southern Europe and Asia Minor was selected for initial study early in the investigation. This report follows the discussion of the 1942 progress published early in 1943.)

EXPERIMENTAL STUDIES

Germination

In a germination study utilizing fifteen different combinations of soil media with watering methods, the highest germination percentages of belladonna seed obtained ranged from 40 to 48 percent, the highest taking place in sand and peat mixtures watered by subirrigation with two wicks, or overhead watering subsequently covered with glass to maintain uniform high moisture. To increase this percentage, seeds were soaked in water, sulfuric acid, hydrochloric acid, stored at cold temperatures prior to planting, stored at high temperature and humidity, alternately heated and cooled in germination media, and planted in soil maintained at 90 degrees Fahrenheit temperature. From these tests it was found that the combination of treatments including immersion for from 60 to 100 seconds in commercial sulfuric acid to weaken seed coats, soaking in water for 24 hours to break dormancy, planting in sandy loam soil, maintaining the flats at a temperature of 90 degrees Fahrenheit the first week, utilizing overhead watering, and covering with a sheet of glass to maintain high moisture resulted in uniform germination of 95 to 100 percent.

Nutrition

For confirmation of the 1942 work, nutrition plots were multiplied fourfold. Eight different nutritional combinations varying the concentrations of nitrogen, phosphorus, and potassium were maintained in soil with a pH of 6.5 to 7.5 and in soil with a pH of 5.5 to 6.5. Sixteen of the plots contained 2 year old plants yielding four harvests and 48 plots contained first year plants yielding three harvests. The crops were cured on racks in a dry, well-ventilated, darkened room. Dry weights were obtained for production figures and the material was ground and assayed for determination of alkaloid yields. Production figures and alkaloid assays were correlated with each pH and nutritional variation. These correlations for both 1942 and 1943 crops appear in Table 1. Production figures throughout this report are in pounds of dry weight per acre unless stated otherwise (12" x 12" planting) and the assay figures are in percentage of alkaloids as determined by the United States Pharmacopoeia method of assay. The concentration of nutrients are: high nitrogen, 50-100 parts per million; low nitrogen, 10-50 parts per million; high phosphorus, 5-10 parts per million; low phosphorus, 1-3 parts per million.

In both years high soil nitrogen levels resulted in greater weight production over low nitrogen. The low pH plots produced higher yields for both years. Lack of uniformity in results of phosphorus and potassium studies over the two years combined with the fact that low applications produce yields in excess of the check

TABLE 1

Belladonna Production and Assays for 1942 and 1943
(Correlation table for nutrition and pH variations)

High Nitrogen	1942	1855 lbs.	.31% alkaloids
	1943	1644	.44%
Low Nitrogen	1942	1311	.33%
	1943	1193	.46%
High Phosphorous	1942	1685	.30%
	1943	1405	.45%
Low Phosphorous	1942	1507	.34%
	1943	1462	.44%
High Potash	1942	1599	.31%
	1943	1375	.44%
Low Potash	1942	1520	.33%
	1943	1421	.45%
pH 7	1942	1719	.33%
	1943	1351	.44%
pH 6	1942	1795	.38%
	1943	1484	.45%
Check	1942	1580	.31%
	1943	1182	.44%

TABLE 2

Composite of Production and Assays for 1942 and 1943
(Correlation table for nutrition and pH variations)

High Nitrogen	Low Nitrogen	High Phosphorous	Low Phosphorous	High Potash	Low Potash	pH 7	pH 6	Check
1749 lbs. .38% alkaloids	1252 .40%	1545 .38%	1484 .39%	1487 .38%	1470 .39%	1535 .39%	1639 .42%	1381 .38%

plots indicate that only low levels of these elements are necessary for optimum production. These results may be seen more clearly in a composite of the two years' results as shown in Table 2.

Time of Fertilizer Application

Due to the fact that the nitrogenous constituents of certain field crops are increased more upon the additions of fertilizers at late stages of growth than at early stages, belladonna plots were enriched with ammonium sulphate at the rate of 4 pounds per 100 square feet at three stages of development, premature, flowering, and fruiting, in an attempt to increase the alkaloid content. The comparison of alkaloid yields of these plants with a check plot is found in Table 3.

TABLE 3

Belladonna Assays of Whole Plants Grown in Plots Nitrated at Three Stages of Growth

Treatment	Alkaloidal Assays
Check plots	.31%
Soil nitrated at premature stage	.37%
Soil nitrated at flowering stage	.22%
Soil nitrated at fruiting stage	.30%

These data indicate that belladonna plots should be fertilized soon after establishment of the plants.

Colchicine Applications

In 1942 a series of belladonna seedlings were treated with colchicine by immersion in solutions of varying concentrations for varying periods of time, or by applying a 1 percent lanolin paste or a 1 percent spray to the growing tips. These plants were carried through the season, seed collected and the seeds planted in 1943. The production of the 1943 plants appears in Table 4.

TABLE 4

Production and Assays of Plants Grown from Seed Collected from Colchicine Treated Mother Plants

Treatment	Production	Assays
Seedling immersion, .3% solution 6 hours	1359 pounds	.46%
Seedling immersion, .3% solution 4 hours	1032	.36%
Seedling immersion, .2% solution 4 hours	1515	.34%
On growing tips, 1% lanolin paste	1302	.27%
On growing tips, 1% aqueous spray	1630	.43%
Check plots	2126	.44%

One year's trials indicate little effect of colchicine on percentage of alkaloids and show a definite decrease in yield.

Plant Hardening Prior to Planting

When seedling plants are maintained in the greenhouse for a long period of time while awaiting proper planting weather, they often become spindly and weak. To determine the results in production of these weakened plants as compared with plants hardened before planting, some were pinched back at the growing tips and maintained in cooler surroundings. Table 5 indicates that the toughening of plants accustoms them to the cold weather of early planting.

TABLE 5

Belladonna Production after Varied Pre-Planting Treatments

Treatment	Temperature	Grams/ Plant	Pounds/ Acre
Greenhouse check (no hardening)	65°F.	25.9	2.26
Pinched back in greenhouse	65°F.	24.9	2044
Pinched back in cold frame	45°F.	38.2	3142

Hardening of plants prior to planting is conducive to quicker establishment in the field and greater yield.

Time of Harvest

As no previous work showed a basis for harvesting belladonna at any particular time, an investigation was carried out to determine the stage of development at which the highest alkaloidal yields could be expected. Results of this study appear in Table 6.

TABLE 6

Belladonna Assays of Plants Harvested at Three Different Stages of Development

Time of Harvest	Alkaloid Yield
Harvest before maturity	0.31%
Harvest at flowering time	0.34%
Harvest at fruiting time	0.29%

From this composite of numerous assays it is apparent that the highest yield of alkaloids may be expected when the harvest is carried on during the flowering period.

Alkaloid Location

In harvesting belladonna a cut is made about 6 or 8 inches above the ground leaving several leaves intact to carry the plants through to the next period of growth and subsequent harvest. As the plants begin to develop again, these leaves frequently attain the size of a man's hand and are conspicuous among the small leaves and growing tips. To determine whether the large or small leaves are higher in alkaloid content, a number of plants in different ages were stripped of both types of foliage. The averages of all these assays for the two types appear in Table 7.

TABLE 7

Averaged Belladonna Assays of Large, Mature Leaves and Young Actively Growing Leaves and Tips

Old Mature Leaves	Young Leaves and Tips
.266%	.381%

The results shown in Table 7 indicate that immature foliage has a greater alkaloid content.

Post Harvest Alkaloid Relocation

For many years herbalists and herbal publications have advocated the curing of medicinal plants by suspending them in dry sheds from cords tied around the stems or roots In the 1942 studies, belladonna plants were cured at first by separating the fresh leaves from

the stems and curing the two parts on trays. Later, due to shortage of labor, plants were cut near their bases and the entire plants impaled on nails driven through long racks. In this way, the plants were cured hanging upside down and the leaves were stripped from the stems after drying. When the assays of these various products were compared, there was found an indication that when whole plants were hung up to cure there was a passage of alkaloids from the stems into the leaves. In order to confirm these results further investigations were developed in 1943. Plant material collected from 2 year old plants in 1942 was assayed with the results shown in Tables 8 and 9.

TABLE 8

Post Harvest Alkaloid Relocation in 2 Year Old Plants

Leaves and stems separated and cured on trays.	Whole Plants Cured on Racks Before Separation.
52% of alkaloids located in STEMS	48% of alkaloids located in STEMS
48% of alkaloids located in LEAVES	52% of alkaloids located in LEAVES

Since the roots of belladonna have been known to contain more alkaloids than other portions of the plant, it was thought that this high content could be transferred to the leaves by hanging the whole plant, including roots, from racks as indicated. Consequently, plots of belladonna were harvested and the plants cured in the two manners described before. See Table 9.

TABLE 9

Post Harvest Alkaloid Relocation in One Year Old Plants Cured with Roots Intact.

Plant Parts Separated and Cured on Trays	Whole Plants Cured on Racks before Separation
50% of alkaloids located in ROOTS	47% of alkaloids located in ROOTS
16% of alkaloids located in STEMS	17% of alkaloids located in STEMS
34% of alkaloids located in LEAVES	36% of alkaloids located in LEAVES

A study of the same type was carried on with plants in three different stages of development. Only stems and leaves were included as may be seen in Table 10.

TABLE 10

Post Harvest Alkaloid Relocation in Plants of Varying Stages of Development.

Developmental Stage of Plants	Parts Cured Separately		Whole Plant Cured Before Separation	
Immature	Stems	55%	Stems	57%
	Leaves	45%	Leaves	43%
Flowering	Stems	54%	Stems	51%
	Leaves	46%	Leaves	49%
Fruiting	Stems	51%	Stems	43%
	Leaves	49%	Leaves	57%

It appears that the post harvest mobility of alkaloids increases with increasing age of the plants.

Two explanations seemed possible for the phenomenon of alkaloid relocation in plants hanging upside down; one, that some physiological process was tending to draw the alkaloids down into the leaves, and the other that the movement was an effect of gravity. To determine the value of this latter explanation, plants were cured while being maintained in an upright position. If the effect were due to gravity, the alkaloids should have moved into the roots. The results appear in Table 11.

TABLE 11

Post Harvest Alkaloid Relocation in Plants Cured in an Upright Position

Plants Cured Separately on Trays	Whole Plants Cured Upright Before Separation
50% of alkaloids located in ROOTS	35% of alkaloids located in ROOTS
16% of alkaloids located in STEMS	22% of alkaloids located in STEMS
34% of alkaloids located in LEAVES	43% of alkaloids located in LEAVES

To positively establish alkaloid movement a special test was devised utilizing only one set of plants and thereby eliminating the confusing factor of natural variation in alkaloidal content of different sets of plants. One-half the leaves of a group of plants were stripped off while fresh and cured on trays while the other half was left on to cure on the plants, hanging from racks. The assays of these two sets of leaves appear in Table 12.

TABLE 12

Post Harvest Alkaloid Relocation into Intact Leaves as Compared with Fresh Stripped Leaves of the Same Plants

One-half of Leaves Stripped Fresh and Cured on Trays	One-half of Leaves Cured on Plants Hanging from Racks
.27% alkaloids	0.39% alkaloids

When mature plants are cured whole, regardless of upright or inverted position, the quantity of alkaloids in the roots is diminished and the quantity in the foliage is increased. If the roots are removed, the alkaloid ordinarily present in the stems is shifted to the leaves.

TABLE 13

Mulching and Winter Survival of Belladonna Plants

Silt loam plots	
Heavy mulch (12 inches strawy manure)	75% survival
Medium mulch (6-8 inches strawy manure)	60% survival
Light Mulch (3-4 inches strawy manure)	57% survival
No mulch	9% survival
Heavy soils plots	
Heavy losses in unmulched and heavily mulched plots. Medium mulch best.	

Mulching

With the thought that it was desirable to carry plants through the winter in order to take advantage of the higher alkaloid yields of 2 and 3 year old specimens, heavy, medium, and light mulches were applied to light loam and heavy soil plots in December, 1942. In the spring of 1943 these plots were checked for survivals. The results appear in Table 13.

Correlation of the winter survivals of equally mulched plots maintained under varying nutritional levels resulted in the information appearing in Table 14.

TABLE 14

Correlation of Winter Survival with Nutrition Levels

High nitrogen plots	64% survival
Low nitrogen plots	84% survival

It appears that reduction of the nitrogen level of the soil toward the end of the growing season is conducive to greater winter survival. Variations found with other elements were insignificant.

SUMMARY

1. *Germination.* To secure high germination immerse seeds for 60-100 seconds in commercial sulfuric acid, soak in water for 24 hours and sow in sandy medium. Maintain a temperature of 90°F. for one week, then reduce to 60°F.

2. *Nutrition.* High nitrogen levels increase production. Low levels of phosphorus and potassium are satisfactory. A pH of 5.5 to 5.6 is most satisfactory.

3. *Time of fertilizer application.* To secure higher assays nitrates should be applied in the vegetative stage.

4. *Colchicine* proved ineffective.

5. *Hardening* of plants prior to planting is conducive to quicker establishment in the field and higher yields.

6. *The highest assays* are secured when *harvesting* takes place during the flowering period.

7. Alkaloids are greater in immature foliage.

8. *Alkaloid relocation.* When mature plants are cured whole, regardless of upright or inverted position, the quantity of alkaloids in the roots is diminished and the quantity in the foliage is increased. If the roots are removed, the alkaloid ordinarily present in the stems is shifted to the leaves.

9. *Mulching.* In light soils a heavy mulch is conducive to overwinter survival. In heavy soils a medium mulch is indicated. Winter survival may also be increased by reduction of the soil nitrogen level to 10-50 p.pm. toward the end of the growing season.

AMMONIUM SULFAMATE, FOR WEEDS

Ammonium sulfamate, the non-flammable chemical compound, sold in limited quantities last year to kill certain noxious weeds, is now available for the first time in amounts adequate for home, farm, and orchard use.

In making this announcement, the Du Pont Company also made public for the first time the new trade name of its product. It is "Ammate," a coined name combining the first and last syllables of the words "ammonium sulfamate."

Ammonium sulfamate acts by penetrating into the plant in different ways to kill the tissues. It kills certain woody perennials, such as poison ivy and chokecherry, by penetration and translocation through the plant to the roots.

It kills numerous annuals, such as chickweed and cocklebur, by penetration into the foliage, and a long list of both shallow-rooted and deep-rooted perennials, including dandelion, goldenrod, Canada thistle, and bindweed, by penetration into foliage plus action on the roots in the soil.

Spray application should thoroughly wet the foliage of woody perennials and annuals, and should be made soon after rainfall or during high humidity, if possible.

For the other perennials, application to foliage and soil should be made before a rain or the area should be irrigated after treatment. High humidity and moist soil help.

Soil sterilization caused by application of ammonium sulfamate may be temporary or prolonged, depending on the conditions of the soil and the amount of ammonium sulfamate used. Sterility may be shortened by applying crushed limestone or slacked lime after the weeds are dead.

FROM EXPLOSIVES TO INSECTICIDES

Conversion of equipment previously used for the manufacture of military explosives into a unit for the production of DDT, new powerful insecticide, will be accomplished at Hercules Powder Company's Parlin, New Jersey, plant.

The conversion is being made at the government's request and the entire output of the insecticide will be turned over to the armed forces.

The section of the Parlin plant which is being converted, known as the "B" line, previously turned out nitrocellulose for the manufacture of smokeless powder for the British armed forces at Hercules' Belvidere, New Jersey, plant.

Both the Belvidere plant and the "B" line section of the Parlin plant were closed last December because the British no longer needed the smokeless powder.

The new insecticide has proved to be such an effective weapon against bodylice, the carriers of typhus fever, that it was decided to utilize part of the idle equipment for the production of DDT rather than build a new plant.

So powerful that a single application to clothing provides anti-louse protection for a month, DDT has proved to be effective against more pests than any insecticide previously used.

DDT is a symbol for dichloro-diphenyl-trichloroethane, the chemical name for the insecticide. Production of this insecticide at the Parlin plant is expected to begin in May.

* * *

It will be the task of research to find new applications and uses for alcohol. Its production from the fruit of the soil will not only result in increased cultivation of former wasteland, it will also provide gainful employment to those who raise the grain or the sugar cane, besides furnishing much needed feeds and many other useful and widely needed byproducts.—Dr. A. J. Liebmann.

CHEMURGY MARCHES ON